BEFORE THE

Federal Communications Commission

WASHINGTON, D.C.

In the Matter of	)	
	)	
Telecommunications Relay Services and	)	CG Docket No. 03-123
Speech-to-Speech Services for Individuals	)	
with Hearing and Speech Disabilities	)	
Petition for Declaratory Ruling on Video Relay	)	
Service Interoperability	)	

COMMENTS OF SNAP TELECOMMUNICATIONS, INC.

Daryl Crouse
SNAP TELECOMMUNICATIONS, INC.
925 Wappoo Road
Suite C
Charleston, SC 29407
(843) 763-3890 (Voice)
(843) 763-3944 (TTY)

Francis M. Buono
McLean Sieverding
WILLKIE FARR & GALLAGHER LLP
1875 K Street, NW
Washington, D.C. 20006-1238
Counsel for Snap Telecommunications, Inc.

Richard L. Schatzberg
AEQUUS TECHNOLOGIES CORP.
107 Windsor Drive
Pine Brook, NJ 07058
(973) 713-4124

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Snap Telecommunications, Inc. (Snap), by its attorneys, hereby files comments on the Further Notice of Proposed Rulemaking in the above captioned proceeding.[1]

I. INTRODUCTION AND SUMMARY

Snap is a wholly owned subsidiary of Aequus Technologies Corp. ("Aequus," pronounced "ē' kwus"), a company with a long-standing commitment to removing barriers and enabling access for people with physical and cognitive disabilities. Snap's entry into VRS comprises a key component of Aequus' mission to use innovative technology to improve access for individuals with hearing and speech disabilities.

On May 8, 2006, the Commission certified Snap as an eligible provider of VRS under its new federal procedures.[2] Snap is currently in the final stages of planning before launching its VRS offerings to the public. Because Snap's VRS network will be based on

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[1] *See In re Telecommunications Relay Services and Speech-to-Speech Services for Individuals with Hearing and Speech Disabilities*, Declaratory Ruling and Further Notice of Proposed Rulemaking, 21 FCC Rcd 5442 (2006) ("*Interoperability Order*").

[2] *See* Public Notice, FCC, *Notice of Certification of Snap Telecommunications, Inc. as a Provider of Video Relay Service (VRS) Eligible for Compensation from the Interstate Telecommunications Relay Service (TRS) Fund*, CG Docket No. 03-123, FCC 06–67 (rel. May 8, 2006). *See also* Erratum, CG Docket No. 03-123 (rel. May 9, 2006).

newer, more advanced open standards -- principally SIP and H.264 -- than those currently prevalent in the VRS marketplace -- H.323 and H.263 -- and will incur significant costs to achieve backward compatibility with these legacy VRS technologies, it is vitally interested in the issues raised in the FNPRM, in particular the questions regarding possible mandatory VRS protocols and related cost reimbursement issues.

The Commission has asked whether it should follow the TRS model and mandate specific protocols that VRS providers must use to receive and place VRS calls. Snap respectfully submits that mandating protocols for VRS is unnecessary and should be avoided in light of the various adequate interoperability, backward compatibility, and non-degradation requirements *already* adopted in the Interoperability Order. In short, the answer to the Commission's question "whether we can ensure interoperability in some way other than mandating protocols"[3] is "yes." The "other way" is via the Commission's enforcement of these comprehensive interoperability mandates.

While it is true, as the FNPRM points out, that the Commission *did* mandate the use of certain protocols in the TRS context (*i.e.*, ASCII and Baudot), the current VRS situation is distinguishable from the one that existed with TRS when the Commission undertook that action. Among other things, when the Commission mandated ASCII and Baudot for TRS, there were no interoperability or backward compatibility rules in place. Instead, the Commission elected to ensure interoperability in the TRS marketplace by mandating the use of two specific protocols by all TRS providers. By contrast, in the case of VRS, as noted, such rules already exist to ensure that the current providers are able to upgrade at their discretion, and that new providers are able to enter the market

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[3] *Interoperability Order* ¶ 57.

using their technology of choice, all without fear that interoperability will be limited or altogether prevented. For example, Snap is currently developing an interoperability solution that will ensure its service is interoperable with the protocols used by existing VRS providers (H.323 and H.263), while at the same time offering VRS users higher-quality functionality (through the newer, more advanced SIP and H.264 protocols). *Notably, Snap's interoperability solution was developed under the current rules, and not as a result of a Commission mandate regarding specific VRS protocols.* Seen in this light, mandated VRS protocols would actually be superfluous and counterproductive.

Moreover, avoidance of mandatory protocols in the VRS context is fully consistent with Commission precedent and the scholarly work of leading economists, jurists, and technology policy experts, who consistently counsel against government-mandated technical standards, and in favor of market-based solutions, particularly in highly dynamic areas. The VRS marketplace -- and, indeed, the entire video telephony marketplace -- is still in the early stages of its maturity, and technological change is likely to continue and even increase in the coming years. During such a dynamic period of development, such precedents and expert learning are particularly instructive -- and they all oppose government-mandated VRS protocols.

If, notwithstanding the foregoing, the Commission nonetheless decides to mandate specific protocols for the provision of VRS, Snap believes that SIP and H.264 would be ideal candidates for such baseline standards. Indeed, based on the extensive discussion of leading signaling protocols and video codecs presented in Section II below, SIP and H.264 are not merely "frills" or unnecessary upgrades to today's legacy VRS standards. Rather, they represent the best path to true functional equivalency in the

current VRS marketplace. Notably, SIP and H.264 will significantly improve the overall calling experience of VRS users to the point where, for the first time, it is truly equivalent to the clear voice quality that is available to hearing individuals making a voice telephone call over the PSTN. Moreover, SIP will provide a superior platform for achieving a robust E-911 solution for VRS users and for fostering greater interoperability and functional equivalency as technology evolves in the future. This latter objective is fully consistent with the Commission's recognition that functional equivalency is an evolving concept that must be periodically reassessed and adjusted over time.[4]

At the same time, however, Snap is mindful that, notwithstanding their significant advantages and their broad support as the leading signaling and video codec open standards in the communications industry, SIP and H.264 are not currently the prevalent standards in the VRS industry, and that any effort to *compel* the entire industry to transition to these standards at this time would likely be costly, burdensome, and time consuming for existing VRS providers and potentially disruptive to VRS users. Again, Snap is not urging the Commission to mandate *any* standards for the reasons set out above. However, if the Commission decides to mandate SIP and H.264, it should afford all VRS providers a sufficient amount of time -- at least 18 months -- to prepare for the transition and implement the new standards into their networks and equipment.

Further, irrespective of which protocols the Commission mandates, if it does so at all, it is essential to allow VRS providers the flexibility to use *other* signaling and video

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[4] *See In re Telecommunications Relay Services and Speech-to-Speech Services for Individuals with Hearing and Speech Disabilities*, Report and Order and Further Notice of Proposed Rulemaking, 15 FCC Rcd 5140, ¶ 4 (2000) ("Functional equivalence is, by nature, a continuing goal that requires periodic assessment.") ("*Improved TRS Order*").

codec standards in their networks and equipment. Among other things, this flexible approach is consistent with the approach taken in the TRS context -- which "[leaves] decisions about technology for relay platforms to the discretion of the relay provider, as long as both Baudot and ASCII are supported 'at any speed generally in use.'"[5] -- and would encourage VRS providers to implement additional, superior signaling protocol and video codec standards in their equipment and networks that provide a higher-quality experience for VRS users, consistent with the functional equivalency and pro-innovation mandates of the ADA.

Finally, consistent with the Commission's rules and precedent, were the Commission to mandate one or more specific protocols, the costs to comply with such a new mandatory minimum standard would be compensable by the Fund, subject to the ability of NECA and/or the Commission to limit certain costs that are found not to be "reasonable" under the circumstances. In addition, even if the Commission decides not to mandate *any* specific VRS protocols in this proceeding, the costs incurred by VRS providers to comply with the Commission's existing interoperability requirements would still be compensable from the Fund. These existing requirements clearly constitute new mandatory minimum standards of the VRS rules since non-compliance renders a VRS provider "ineligible for compensation from the Interstate TRS Fund." This conclusion is not simply required by the Commission's rules and precedent regarding reimbursement for reasonable costs to comply with non-waived mandatory minimum standards, but equally important, it is also the correct public policy choice: Reimbursement for interoperability and backward compatibility costs encourages providers -- both existing

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[5] *Id.* ¶ 143 (*citing* 47 C.F.R. § 64.604(b)(1)).

providers that are currently using H.323 and H.263, and future market participants alike -- to invest in and implement technologies that continue to achieve functional equivalency and better serve VRS users.

II. FACTUAL BACKGROUND

The Interoperability FNPRM asks whether the Commission should follow the TRS model and mandate specific Internet protocols that VRS providers must use to receive and place VRS calls.[6] With respect to signaling protocols, the FNPRM specifically raises the SIP vs. H.323 comparison, but no other standards are mentioned. However, Snap notes that since video codec standards for video compression, such as H.263 and H.264, can also present interoperability challenges, they should be part of the Commission's deliberations in this proceeding.[7] To assist the Commission in making its determinations in this area, we set out below some factual information and comparisons of the standards currently used by existing VRS providers (namely, the H.323 signaling protocol and H.263 video codec) and the technologies that Snap will use upon the launch of its video relay service (namely, the SIP signaling protocol and H.264 video codec).[8]

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[6] *Interoperability Order* ¶ 44.

[7] "Video codecs," such as H.264 and H.263, are devices or software modules that enable the compression or decompression of digital video content, so that such video content can be transmitted over a network using less bandwidth than if the entire, uncompressed version of the content were transmitted intact. *See Video Codec, at* http://en.wikipedia.org/wiki/Video_codec. Given the inherently video-based nature of VRS, the video codec implemented in a VRS provider's network is a key element of the provider's offerings.

[8] In addition to the signaling protocol and video codec standards discussed herein, video phones implement *audio* codecs as well. Snap notes that all of the current video phones used by existing VRS providers, as well as all other video phones available in the market, support, at the very least, the G.711 standard. For further information regarding G.711, *see* http://www.itu.int/rec/T-REC-G.711/e or http://en.wikipedia.org/wiki/G.711. *See also* the attached Exhibit for charts listing the video phones used by all existing VRS providers and other video phones, as well as the signaling protocols, video codecs, and audio codecs implemented by each.

A. Comparison of H.323 v. SIP

1. H.323

Developed by the International Telecommunications Union ("ITU") in 1996, H.323 is a real-time, vertically-integrated suite of protocols that defines all components of conferencing networks, including terminals, gateways, gatekeepers, multipoint control units ("MCUs"), and other feature servers.[9] H.323 provides specification for computers, equipment, and services for multimedia communication over networks that do not provide a guaranteed quality of service.[10] H.323 computers and equipment can carry real-time video, audio, and data, or any combination of these elements. A user of H.323 can connect with other people over the Internet and use varying products that support H.323.[11]

H.323 uses various protocols, including for call setup, call signaling, exchanging terminal capabilities and creation of media channels, registration and admission control, sequencing audio and video packets, codec specification, and data conferencing - all of which must be negotiated to set up a point-to-point call.[12] To initiate a call through H.323: (1) a client receives the address of another user from an H.323 gatekeeper, (2) a session is established with the client using another protocol, and (3) once the session has

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[9] *See* SIP Center, *H.323 Background*, *at* http://www.sipcenter.com/sip.nsf/html/H.323+Background (last visited June 14, 2006).

[10] *See* Microsoft Corp., *Chapter 11: Understanding the H.323 Standard*, *at* http://www.microsoft.com/windows/NetMeeting/Corp/reskit/Chapter11/default.asp (last visited June 14, 2006).

[11] *See id.*

[12] *See* SIP Center, *H.323: The Basics*, *at* http://www.sipcenter.com/sip.nsf/html/H.323+-+The+Basics (last visited June 14, 2006).

begun, yet *another* protocol negotiates the available features and functions of that session.[13] Currently, all existing VRS providers rely solely on the H.323 protocol.[14]

2. SIP

Adopted by the Internet Engineering Task Force ("IETF") in 2001, Session Initiation Protocol ("SIP") is an open standard signaling protocol that initiates sessions between hosts in an IP-based network so that they may exchange information.[15] In contrast to H.323, SIP user agents can communicate directly and efficiently with each other, or through SIP servers, and are normally configured with an outbound proxy that forwards SIP messages on the user's behalf.[16] By its use of REGISTER requests to bind users' logical addresses to their physical addresses, SIP can easily handle routing services.[17] SIP allows communicating parties to agree on what media to exchange and how to exchange it, instead of transporting the media content itself.[18]

3. Benefits of SIP over H.323

SIP provides many benefits over the legacy H.323 standard. Among other things, SIP has a more efficient, simplified architecture, and is more extensible and flexible than H.323. Additionally, SIP has been the technology of choice in significant efforts by various industry players to establish E-911 solutions for VoIP and VRS. The factors

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13 *See id.*

14 *See Interoperability Order* ¶ 55.

15 *See* Matthew Mintz-Habib, Anshuman Rawat, Henning Schulzrinne, & Xiaotao Wu, Columbia Univ. Dep't of Computer Sci., *A VoIP Emergency Services Architecture and Prototype* 1 (Oct. 2005), *available at* http://www.cs.columbia.edu/IRT/papers/Mint0510_VoIP.pdf.

16 *See id.*

17 *See id.*

18 *See id.*

enumerated below validate the reasons why SIP is increasingly being embraced as the standard of choice in the video phone, VoIP, and other arenas across the communications industry.

a. Simplified Architecture

H.323 is a complex collection of various protocols that uses a lot of code and is not developer friendly.[19] H.323's base specifications alone total 736 pages and hundreds of elements.[20] In contrast, SIP is a simpler, text-based protocol that uses the same headers, errors, and encoding rules as the well-known and successful Hyper Text Transfer Protocol ("HTTP").[21] SIP only has 128 pages of base specifications and 37 headers, which make SIP messages easier to read and debug, and allows designers to more easily program new services.[22] As noted, H.323 has components for call signaling, transmission control, multimedia management, and bandwidth control - all of which must be followed in order to make a simple call.[23] This often results in noticeably longer call setup time, with the delay depending on the type of network being used.[24] SIP, on the

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[19] *See* Susan Breidenbach, *How to Handle SIP*, VoIP Magazine, Nov. 3, 2005, *at* http://www.voip-magazine.com/content/view/562/ (free registration required); Scott Tyler Shafer, *SIP Pundits Voice Support*, Infoworld.com, Aug. 9, 2002 (relaying the statements of Dave Passmore, an analyst at Burton Group), *at* http://www.infoworld.com/article/02/08/09/020812nesip_1.html; Linden DeCarmo, *Internet Telephony Protocols: H.323 versus SIP*, DrDobb'sPortal, July 22, 2001, *at* http://www.ddj.com/184410988.

[20] *See* Henning Schulzrinne, Columbia Univ. Dep't of Computer Sci., *A Comparison of SIP and H.323 for Internet Telephony* 1, *at* http://www.cs.columbia.edu/IRT/papers/Schu9807_Comparison.pdf.

[21] *See* Shafer, *supra* note 19.

[22] *See* Schulzrinne, *supra* note 20, at 1; Ubiquity, *Understanding SIP - Today's Hottest Communications Protocol Comes of Age* 3 (2004), *available at* http://www.sipcenter.com/sip.nsf/html/WEBB5YP4SU/$FILE/Ubiquity_SIP_Overview.pdf.

[23] *See* IHS Inc., *A Tale of Two Protocols*, Feb. 2005, *at* http://electronics.ihs.com/newsletters/tele-feb05_2.jsp.

[24] *See id. See also H.323: The Basics*, *supra* note 12.

other hand, must only perform one function: to initiate call sessions. It finds the receiver of an IP-based call using either a phone number or a Web address that is similar to a URL address, such as "SIP:yourname@host.com."[25]

In contrast to H.323, SIP operates independent of the underlying network transport protocol and is indifferent to the type of media being used.[26] If a service or session initiates video and voice, voice can still be transmitted to non-video enabled devices, or other device features can be used such as one-way video streaming.[27] Because SIP messages are formatted as text, they also use less bandwidth as the system attempts to place an IP-based call.[28] Finally, SIP re-uses MIME type description in the same way that email clients do, allowing applications associated with sessions to be launched automatically.[29]

b. Greater Extensibility and Flexibility

While H.323 does have "extensibility" mechanisms (*i.e.,* the ability to evolve and accommodate new technologies and features), it has many limitations. For instance, it has no mechanism for permitting terminals to exchange information about which new extensions each supports.[30] Moreover, when it comes to integration with other standards and protocols, H.323 takes an umbrella and hard-wired approach by incorporating a vertically integrated sub-protocol suite of multiple standards, including H.225, H.245,

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25 *See A Tale of Two Protocols*, *supra* note 23.

26 *See Understanding SIP*, *supra* note 22, at 1.

27 *See id.*

28 *See A Tale of Two Protocols*, *supra* note 23.

29 *See id.*

30 *See* Schulzrinne, *supra* note 20, at 1.

H.450, RAS, Q.931, and others to address other functions. Hence, from a new features/services perspective, there is no clean separation of these sub-protocols, which makes it difficult to develop and implement new innovations within the H.323 framework.[31] SIP, in contrast, has emulated HTTP and SMTP by building in a simple yet rich set of extensibility and compatibility functions. SIP encompasses mainly user location, registration, and basic session signaling. For advanced services/features, other functions like capability exchange, service discovery, quality of service, directory access, and conference control reside in separate, modular protocols that can be integrated and replaced within the SIP framework in a straightforward manner.[32]

In addition, SIP allows for data and voice convergence for devices and applications across a wide range of industry sectors, enabling voice, video, instant messaging, and other media, and facilitating presence and location-based services.[33] Re-using a large selection of modular protocols that are already being utilized by applications for the Internet and other IP-based networks, SIP allows for real-time, mobile, and seamless collaboration.[34] *As a result, SIP affords significant opportunities for enhanced interoperability and innovation going forward because its highly extensible design makes it easier, in contrast to H.323, to substitute new protocols, applications,*

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[31] *See id.*

[32] *See id.*

[33] *See generally* Mohammad Kolbehdari et al., *Session Internet Protocol (SIP) Evolution in Converged Communications*, 10 Intel Tech. J. 11, 11 (2006), *available at* http://www.intel.com/technology/itj/2006/volume10issue01/art02_sip_evolution/p03_sip.htm.

[34] *See id.*

and modules in VRS phones and servers as advances in technology and standards development occur over time.

c. Superior Foundation for E-911 Solutions

The precise location information of E-911 callers is necessary to route calls to proper public safety answering points ("PSAP") and to dispatch help to callers.[35] Therefore, it is essential that VRS systems have the best available technology for enabling the deaf and hard of hearing community to contact help when necessary. Because SIP uses MIME technology for content formatting, both location information and media description can form a multipart entity in SIP message content.[36] Consequently, using SIP, service providers will be able to know who is on their network and where they are located, allowing them to seamlessly route E-911 calls nationally to support end users.[37] Indeed, SIP is currently the focus of extensive efforts not only by Snap, but by leading industry players and standards organizations such as the IETF to develop a robust E-911 solution for IP-based services like VoIP and VRS (*e.g.*, TeleCommunication Systems, Inc., Red Sky Technologies and Convergence, Intrado, Level 3, Verizon, Global Crossing, and various working groups of the IETF are all exploring or implementing SIP-based E-911 solutions).[38] *No comparable efforts are underway to develop E-911 solutions for VoIP or VRS using H.323 as a foundation*.

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[35] *See* Mintz-Habib, *supra* note 15, at 3.

[36] *See id.* at 1.

[37] *See* Press Release, Convergence, Inc., *Convergence, RedSky Team to Develop E-911 Solution for VoIP Service Providers* (Mar. 8, 2006), *available at* http://www.covergence.com/press.php?id=33.

[38] *See, e.g.*, Johanne Torres, *TCS Intros MSAG-Based Routing for VoIP 911 Calls*, TMCnet.com, June 13, 2006, (discussing TeleCommunication Systems, Inc.'s move to SIP for E-911), *at* http://www.tmcnet.com/channels/e911/articles/1526-tcs-intros-msag-based-routing-voip-911-calls.htm;

d. Broadly Embraced as the Technology of Choice

Today, increasingly more providers are switching from H.323 to SIP for a number of reasons, such as the protocol's versatility and its ability to integrate easily with other Internet protocols. Numerous video phone manufacturers (*e.g.*, Innomedia, Grandstream, 8x8 and Leadtek, Corinex, ProVU, and Ittiam/Texas Instruments),[39] VoIP providers (*e.g.,* Vonage, British Telecom, pulver.com, AT&T, BellSouth, Time Warner Cable, and Comcast Cable),[40] and others (*e.g.,* Google, Microsoft, Nortel, and Cisco)[41] are

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Convergence, Inc. *supra* note 37; SIP Center, *Intrado Integrates Acme Packet Net-Net Session Border Controllers into VoIP E9-1-1 Solution*, Nov. 15, 2005, *at* http://www.sipcenter.com/sip.nsf/newsview?open&type=News&docid=WEBB6J6N4X; Level 3 Communications, Inc., *Level 3 E-911 Direct Service: FCC Compliance -- with Confidence*, *at* http://www.level3.com/4176.html (last visited June 21, 2006); Jay Lyman, *Vonage Hooks Up with Verizon on 911 Service for VoIP*, Tech. News World, May 5, 2005, *at* http://www.technewsworld.com/story/42897.html; David Sims, *Global Crossing Now Avaya SIP-Compliant*, TMCnet.com, Oct. 19, 2005, *at* http://news.tmcnet.com/news/-sip-avaya-china-/2005/oct/1194916.htm; Carolyn Duffy Marsan, *IETF Taking on 911 Problem Within VoIP*, Network World, Mar. 13, 2006, *available at* http://www.networkworld.com/news/2006/031306specialfocus-911-voip.html.

[39] *See, e.g.,* Press Release, Innomedia, Inc., *Innomedia Selected by Net2Phone for SIP Broadband VOIP* (July 7, 2004), *at* http://www.innomedia.com/pressroom/releases/2004-07-07_Net2Phone.htm; Press Release, D-Link Corp., *D-Link Launches First Flip-Style Mobile WI-Fi Phone; Comes Pre-Loaded with TelTel Softphone; Compact, D-Link, SIP-Based Phone Allows Users to Make Free Calls Over the Internet via Wi-Fi Connection* (Mar. 14, 2006), *available at* http://www.dlink.com/press/pr/?prid=267; Press Release, Grandstream Networks, Inc., *Texas Instruments Powers Grandstream Networks' GXP-2000 Enterprise IP Phone; Extended Functionality of TMS320C5501 DSP Gives SIP Phone Superior Voice Clarity, Enhanced Security Protection* (June 5, 2006), *available at* http://www.grandstream.com/Grandstream_TI_PressRelease_june2006.pdf; *8x8 and Leadtek Unveil SIP Videophone*, Converge! Network Digest, Jan. 6, 2004, *at* http://www.convergedigest.com/searchdisplay.asp?ID=9783&SearchWord=Leadtek; Brooks Talley, *Corinex Introduces Videophone, VoIP Products*, eHomeUpgrade.com, Nov. 16, 2004, *at* http://www.ehomeupgrade.com/entry/329/corinex_introduces_videophone; ProVu Communications Ltd., *SIP Overview*, *at* http://www.provu.co.uk/sipoverview.html (last visited June 19, 2006); Press Release, Ittiam Systems Ltd., *Ittiam Announces its Next Generation IP Video Phone Solution* (Oct. 26, 2005), *available at* http://www.ittiam.com/pages/news/pres-rel-20051026.htm. *See* the Exhibit to these comments for charts listing various video phones on the market and which signaling, video, and audio standards they support.

[40] *See, e.g., Avaya SIP Solution for Vonage*, CB Magazine, Jan. 9, 2005, *at* http://www.cbmagazine.co.uk; Stefania Viscusi, *SIP Week in Review*, TMCnet.com, May 5, 2006, (discussing British Telecom's use of the SIP standard), *at* http://news.tmcnet.com/news/2006/05/05/1639536.htm; *SIP Product List*, Pulver.com, *at* http://www.pulver.com/products/sip/ (last visited June 19, 2006); *Ubiquity SIP Application Server Purchased by AT&T Services, Inc. for VoIP Application*, Bus. Wire, Jan. 17, 2006, *available at* http://www.sipcenter.com/sip.nsf/newsview?open&type=News&docid=WEBB6L5MSE; Ellen Muraskin,

increasingly using SIP as their standard of choice. *Indeed, even D-Link, one of the major manufacturers of VRS video phones and longtime supporter of H.323, recently launched a number of consumer equipment and server products that are SIP-based*.[42] Vendors developing third-generation wireless technology ("3G") are also adopting SIP.[43] New players continue to enter the SIP market with innovative services, and SIP is on its way to becoming one of the most significant protocols since HTTP and SMTP.[44] Industry acceptance of SIP has grown exponentially because, among other things, "[i]ts scalability, extensibility, and -- most important -- flexibility appealed to service providers and vendors who had needs that a vertically integrated protocol, such as H.323, could not address."[45]

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*BellSouth to Sell Nortel's Multimedia SIP Serve*r, eWeek.com, Nov. 15, 2004, *available at* http://www.eweek.com/article2/0,1759,1727450,00.asp; Press Release, Viseon Inc., *Time Warner Cable Launches Videoconferencing Initiative with Viseon's VisiFone*. Sept. 28, 2004 (noting that Time Warner Cable uses the VisiFone, which is SIP compliant), *available at* http://www.viseon.com/n_readmore.asp?newsID=143; *The Cable VoIP Scorecard: Cable Companies Hit Home Runs with New VoIP Deployments*, XChange Magazine, June 1, 2005 (discussing Comcast Cable's use of SIP), *available at* http://www.xchangemag.com/articles/561services1.html.

[41] *See, e.g.,* Google Inc., *Talk and Open Communications*, Jan. 17, 2006, *at* http://www.google.com/talk/developer.html (last visited June 22, 2006); Ross Carter, *Microsoft Real-Time Communications: Protocols and Technologies*, July 3, 2003, *available at* http://www.microsoft.com/technet/prodtechnol/winxppro/plan/rtcprot.mspx; Nortel Networks Corp., *SIP Multimedia PC Client*, *at* http://www.nortel.com/products/01/succession/cs/sip_pcclient.html (last visited June 19, 2006); Cisco Systems Inc., *Session Initiation Protocol (SIP)*, *at* http://www.cisco.com/warp/public/cc/techno/tyvdve/sip/index.shtml (last visited June 19, 2006).

[42] *See* Press Release, D-Link Corp., *D-Link Ready To Meet VoIP Demand; Full Product Lineup At Spring '06 Von Show*, *available at* http://www.dlink.com/press/pr/?prid=269 (Mar. 15, 2006).

[43] *See A Tale of Two Protocols*, *supra* note 23 (describing how in 2001, two groups of telecommunications partners dedicated to developing 3G specifications, the Third Generation Partnership Project and Third Generation Partnership Project 2, chose SIP over H.323 as their signaling protocols).

[44] *See Understanding SIP*, supra note 22, at 2.

[45] Jonathan D. Rosenberg & Richard Shockey, *The Session Initiation Protocol (SIP): A Key Component for Internet Telephony*, June 14, 2000, *available at* http://www.cconvergence.com/shared/printableArticle.jhtml?articleID=8700868.

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In short, SIP provides a superior alternative to H.323. SIP has near-universal support among vendors of communications products and services and is "the Gold Standard for real-time communications in the enterprise."[46] As TMCnet analyst Bob Liu wrote, "SIP has become accepted as a mature and commercially-viable Internet Protocol ("IP") standard that is being widely adopted by global carriers and large enterprises that plan to deploy a new generation of converged services."[47] Although many players are still using H.323 for VoIP signaling, "it is clearly just a legacy, and no new challenger to SIP has emerged."[48]

B. Comparison of the H.263 v. H.264 Video Codecs

1. H.263

Created by the ITU in the mid-1990s, H.263 is a video codec[49] designed for low-latency video conferencing applications.[50] H.263 supports thirty frames per second of video, and was designed to replace the older H.261 model.[51]

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46 *Id*.

47 Stefania Viscusi, *SIP Week in Review*, TMCnet.com, May 5, 2006, *at* http://news.tmcnet.com/news/2006/05/05/1639536.htm.

48 Breidenbach, *supra* note 19.

49 *See* definition of "video codec," *supra* n. 7.

50 *See* Apple Computer, Inc., *Quicktime, H.264 Frequently Asked Questions*, *at* http://www.apple.com/quicktime/technologies/h264/faq.html (last visited June 14, 2006).

51 *See* Ray Patalano, *H.263 Compresses Video Over IP*, Network World, Sept. 23, 2002, *at* http://www.networkworld.com/news/tech/2002/0923tech.html.

2. H.264

Adopted in December 2001, H.264 is the newest open standard for video compression developed by the Joint Video Team, ITU, and the International Organization for Standardization's ("ISO") Moving Picture Experts Group ("MPEG").[52] H.264 uses the MPEG-4 standard, also known as MPEG-4 Par 10. H.264 video compression enables video users to experience either significantly improved video quality at the same or lower bit rate as previous video codecs, or current quality at approximately half the bit rate previously required,[53] and it delivers this excellent video quality across the entire bandwidth spectrum - from 3G to HD and everything in between (from 40 Kbps to upwards of 10 Mbps).[54]

3. Benefits of H.264 over H.263

H.264 offers many benefits over its predecessor H.263, including superior image quality, decreased complexity, simplified structure, and decreased network errors, as described below.

a. Superior Image Quality

H.264 revolutionizes video telephony by allowing fifty percent or more in bit rate savings over H.263 while still achieving much higher visual quality.[55] Moreover, in

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[52] *See* Polycom Video Communications, *H.264 and Pro-Motion: The Polycom Office Video Advantage*, July 12, 2004, at 2, *available at* http://www.polycom.com/common/pw_cmp_updateDocKeywords/0,1687,2601,00.pdf; 4i2i Communications Ltd., *H.264 Software Video Codec*, June 2005, *available at* http://www.4i2i.com/downloads/h264_software_2005.pdf; Apple Computer, Inc., *supra* note 50.

[53] *See* Polycom Video Communications, *supra* note 52, at 2.

[54] *See id.*

[55] *See* UB Video Inc., *H.264 Based Video Conferencing Solution: Overview and TMS320DM642 Digital Media Platform Implementation,* White Paper, Nov. 2002, *available at* http://focus.ti.com/lit/ml/spry084/spry084.pdf.

contrast to H.263, H.264 allows for video calls over low bandwidth connections.[56] This leads to a more efficient use of an existing communications infrastructure and an increase in the accessibility and cost-effectiveness of high-quality video telephony.[57] For example, because H.264 includes advanced compression, transmission, and error concealment technologies, the Ojo video phone Snap plans on using for its VRS offerings provides superior "true to life" video quality at a much lower data rate (110 Kbps) than existing video phones, which will alleviate the need for VRS users to purchase an expensive "business class or premium" broadband service simply to make and receive VRS calls. In short, H.264 allows for much higher quality video calling at lower bandwidth and lower costs to providers and end users. For a real-time comparison between the two codecs, *see* Anthony Shen, *A Comparison of Codecs in QuickTime - MacCentre 701*, *at* http://mac.sillydog.org/qt/compare.php.

b. Simplified Architecture

The profile structure of H.264 -- the compression techniques used by the standard -- are much simpler than in H.263. In H.263, there are over one million possible mode combinations, whereas H.264 only has three possible profiles.[58]

c. Decreased Network Errors

The H.264 baseline profile comes equipped with more sophisticated error resilience tools than exist for H.263, which provide for good video quality even on error-prone networks such as the Internet. This means that when network errors cause video

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56 *See* Polycom Video Communications, *supra* note 52, at 2.

57 *See id.*

58 *See id*.

data to be lost, the video quality will slowly degrade instead of breaking up instantly and leaving the consumer with unusable video images. Additionally, H.264 allows for low latency coding and decoding, which make video calls appear more natural.[59]

d. Broad Acceptance by Industry

Many industry players have adopted H.264 for its superior video-compression capabilities and other benefits, including Apple, DIRECTV, 4i2i, Polycom Video Communications, Lead Technologies, IBM, and Cisco,[60] and the open standard has been integrated into many popular applications and products, including the PlayStation Portable, iPod, the Nero Digital product suite, Mac OS X v10.4, and HD DVD/Blu-ray Disc.[61]

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In short, H.264 offers many advantages in quality and network efficiency over H.263. Praised as the "ultimate, most efficient and flexible, full D1 video compression solution available today," H.264 is considered the greatest achievement in video

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[59] *See id.*

[60] *See* MediaCoder, *Glossary, Video - H.264/MPEG-4 AVC*, *at* http://mediacoder.sourceforge.net/glossary/H264.htm (last visited June 19, 2006) (listing many companies around the world that have initiated use of H.264); Apple Computer, Inc., *supra* note 50; Robert Heron, *DirecTV's HD future is MPEG-4*, PCMAG.com, Jan. 6, 2005, *at* http://www.pcmag.com/article2/0,1759,1748991,00.asp; Polycom Video Communications, *supra* note 52; Press Release, Lead Technologies, Inc., *LEAD Announces Release of LEADTOOLS Multimedia v14.5 SDKs* (May 17, 2005), *available at* http://www.leadtools.com/Home2/press/MM14.5press.htm; Press Release, IBM Corp., *IBM and Partners Create Open Framework for Digital Media* (Oct. 27, 2004), *available at* http://www.ibm.com/press/us/en/pressrelease/7379.wss.

[61] *See Video Codec, at* http://en.wikipedia.org/wiki/Video_codec (last visited July 12, 2006).

compression in the past ten years and is already being broadly implemented by leading companies and products across the communications and content industries.[62]

III. MANDATORY VRS PROTOCOL ISSUE

A. There is No Present Need for the Commission to Establish Mandatory Protocols for the Provision of VRS.

The FNPRM asks whether the Commission should follow the TRS model and mandate specific protocols that VRS providers must use to receive and place VRS calls.[63] Snap respectfully submits that not only is mandating protocols for VRS unnecessary in light of the various existing and adequate requirements *already* set forth in the Interoperability Order, but to do so would also be contrary to established Commission precedent and the opinions of many learned scholars, jurists, and other experts admonishing against government-mandated technical standards, particularly in highly dynamic industries. As discussed below, Snap believes that the Commission can achieve the desired benefits through enforcement of its existing rules and a more flexible, efficient, market-driven approach.

1. The Commission's Existing Requirements for Interoperability and Backward Compatibility, Along with the Prohibition on Degraded Service Quality, Obviate the Need for Mandated VRS Protocols.

The Interoperability Order established three key requirements, which, taken together, obviate the need to mandate the use of specific VRS protocols:

- *First*, the Commission made clear that "all VRS consumers must be able to place a VRS call through any of the VRS providers' service, and all VRS providers

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62 *See* W&W Communications, *BC-264: H.264 Baseline Profile Software Codec*, *at* http://www.wwcoms.com/products/codec/BC-264-0008-web.pdf (last visited June 14, 2006).

63 *Interoperability Order* ¶ 54.

must be able to receive calls from, and make calls to, any VRS consumer."[64] Although all VRS providers currently use the H.323 and H.263 standards, this requirement is important to ensuring that interoperability is preserved, for example, as incumbent providers transition to more efficient and advanced technologies, such as SIP and H.264.

- *Second*, the Commission established the requirement that "new providers seeking to offer [the VRS] service have the burden of ensuring that their service is interoperable with existing providers' service."[65] Thus, irrespective of the technologies they intend to use, all new entrants must ensure backward compatibility with existing VRS providers.

- *Third*, the Commission explicitly prohibited the "practice of providing degraded service quality to consumers using VRS equipment or service with another provider's service."[66] This limits the ability of VRS providers to circumvent the new requirements by implementing a standard that may be technically interoperable, but which degrades service in such a way as to limit the appeal of using another provider's VRS service.

In short, the answer to the Commission's question "whether we can ensure interoperability in some way other than mandating protocols"[67] is "yes." The "other way" is via enforcement of the above interoperability, backward compatibility, and non-degradation requirements. For example, as explained in detail in Section IV.A. below, Snap plans to provide VRS using the more advanced and efficient protocols, SIP and H.264, and, consequently, it has undertaken the requisite tasks and expense to develop an interoperability solution that will ensure its service is interoperable with the protocols used by existing VRS providers, while at the same time offering VRS users higher-quality functionality. *Notably, Snap's interoperability solution was developed under the current rules, and not as a result of any mandatory VRS protocols*.

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64 *Interoperability Order* ¶ 29.

65 *Id*. ¶ 34.

66 *Id*.

67 *Id*. ¶ 57.

The same will be true when any other new entrant enters the VRS marketplace; they too will have to ensure interoperability with the existing VRS providers, and thus interoperability will be maintained even in the absence of mandated VRS protocols. Likewise, when any of the incumbent VRS providers upgrade their networks to implement new signaling protocols and/or video codecs, interoperability will be maintained simply by virtue of the existence and enforcement of the Commission's existing interoperability requirements set forth above to these incumbent provider upgrades.

While it is true, as the FNPRM points out, that the Commission *did* mandate the use of certain protocols in the TRS context (*i.e.*, ASCII and Baudot), the current VRS situation is distinguishable from the one that existed with TRS when the Commission undertook that action. Specifically, when the Commission mandated ASCII and Baudot for TRS, there were no interoperability or backward compatibility rules in place. Instead, the Commission elected to ensure interoperability in the TRS marketplace by mandating the use of two specific protocols by all TRS providers. By contrast, in the case of VRS, as noted, such rules *already* exist to ensure that the current providers are able to upgrade at their discretion, and that new providers are able to enter the market using their technology of choice, all without fear that interoperability will be limited or altogether prevented. Seen in this light, mandated VRS protocols are unnecessary and, as shown in the next section, are inadvisable for other reasons as well.[68]

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[68] One other difference is that when the Commission mandated ASCII and Baudot, TRS users were generally required to purchase their own equipment and, although the Commission acknowledged that ASCII was a superior technology, it was unwilling to render worthless a considerable amount of existing TTY equipment. *See Telecommunications Services for Individuals with Hearing and Speech Disabilities, and the Americans with Disabilities Act of 1990,* 6 FCC Rcd 4657, ¶ 20 (1991). Mandating the Baudot protocol for TRS was thus viewed by the Commission as a way to ensure that TRS users could obtain the

2. Avoidance of Commission-Mandated Standards in the VRS Context is Fully Consistent with Commission Precedent and with the Scholarly Work of Leading Experts in the Fields of Law, Economics, and Technology Policy.

The benefits of technical standards to the communications industry are indisputable. At the same time, the U.S. government, including the Commission itself, has consistently -- and wisely -- been reluctant to mandate technical standards, exhibiting instead a clear preference for market-based solutions, particularly in highly dynamic areas.[69]

As Supreme Court Justice Breyer has observed, governments, lacking the sophistication and granular knowledge of the industry, can fail "to correctly match the [regulatory] tool [used] to the problem at hand."[70] And history has shown that government failure is most likely to occur when a market is new. As the Commission

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maximum benefit over the useful life of their Baudot-only TTY terminals. *See infra* n. 84. By contrast, most VRS users obtain their video phone equipment and/or software from a VRS provider free of charge. Mandating VRS protocols are therefore unnecessary in this sense as well.

[69] *See, e.g.,* National Technology Transfer and Advancement Act of 1995, Pub. L. No. 104-113, § 12(d), 110 Stat. 775 (1996) (codified at 15 U.S.C. § 272 Note) (establishing the statutory mandate that federal government agencies use commercially developed "voluntary consensus standards" unless doing so would be against the law or otherwise impractical); *OMB Circular No. A-119, Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities*, 63 Fed. Reg. 8546 (Feb. 19, 1998) (listing policies of the OMB Circular A-119) (providing detailed guidance to federal agencies regarding and clarifying that standards developed by any private sector standards setting enterprise would meet the meaning of voluntary consensus standards for the purposes of the requirements of Circular A-119). *See also* Memorandum from Secretary of Defense William Perry to the Secretaries of the Military Departments et al., June 29, 1994 (App. A to *The Impact of Acquisition Reform on Department of Defense Specifications and Standards for Materials and Processes: Report of the Workshop on Technical Strategies for Adoption of Commercial Materials and Processing Standards in Defense Procurement*, Oct. 11-12, 2000, Washington, D.C., National Academies Press (2002)), *at* http://newton.nap.edu/books/NI000395/html/37.html, in which the Department of Defense expressed its intent to increase its use of commercial technologies and the use of performance standards and commercial specifications and standards in "in lieu of military specifications and standards, unless no practical alternative exists to meet the user's needs."

[70] Stephen Breyer, REGULATION AND ITS REFORM (Harvard Univ. Press 1982). *See also* Sidney A. Shapiro, *American Regulatory Policy: Have We Found the "Third Way"?,* Symposium Papers, 48 U. Kan. L. Rev. 689 (2000).

itself has observed, it is a perilous time to regulate "when consumer demands, business plans, and technologies remain unknown, unformed or incomplete."[71]

Drs. Stanley M. Besen and Leland L. Johnson, two prominent experts on technical standards, have long argued that, when industry is in a period of high innovation and volatility, the likelihood that a government-mandated standard will result in inefficient and/or artificial technological decisions is particularly acute. As Besen and Johnson conclude:

> [T]he government should refrain from attempting to mandate or evaluate standards when the technologies themselves are subject to rapid change. A major reason for the Commission's difficulty in establishing the first color television standard was the fact that competing technologies were undergoing rapid change even during the Commission's deliberations. It is only after the technologies have "settled down" that government action is most likely to be fruitful, as illustrated in the TV stereo case. … The lesson of the personal computer ("PC") industry further demonstrates the benefits of allowing the marketplace to establish standards in progressive and dynamic industries. During the past decade, the American PC industry has dominated the worldwide market. Market forces have successfully generated the necessary de facto standards and critical interfaces required to achieve compatibility while not impeding innovation.[72]

This perspective is reflected in the Commission's prior thinking in regard to regulatory intervention in standards-setting in telecommunications. For example, the Commission adopted this market-based approach in the licensing of PCS spectrum, concluding that the

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[71] *In re Implementation of Section 304 of the Telecommunications Act of 1996; Commercial Availability of Navigation Devices*, Report and Order, 13 FCC Rcd 14775, ¶ 14 (1998), *subsequent history omitted.*

[72] Stanley M. Besen & Leland L. Johnson, COMPATIBILITY STANDARDS, COMPETITION, AND INNOVATION IN THE BROADCASTING INDUSTRY (Rand Corp. Nov. 1986). *See also* Thomas Sowell, BASIC ECONOMICS: A CITIZEN'S GUIDE TO THE ECONOMY (Basic Books, rev. & expanded ed. 2004) (stating "Markets are indeed imperfect, as everything human is imperfect. But 'market failure' is not a magic phrase that automatically justifies government intervention, because the government can also fail—or even make things worse."); Victor Stango, *The Economics of Standards Wars, in* 3 REVIEW OF NETWORK ECONOMICS 9-10 (Issue 1, Mar. 2004) (*citing* S.J. Liebowitz & S.E. Margolis, *Path Dependence, Lock-In and History*, 11 J.L. Econ. & Org. 205-206 (Oxford Univ. Press 1995)).

rapid technological change in PCS development demanded a flexible regulatory approach to technical standards:

> [M]ost parties recognize that PCS is at a nascent stage in its development and that imposition of a rigid technical framework at this time may stifle the introduction of important new technology. We agree, and find that the flexible approach toward PCS standards that we are adopting is the most appropriate approach.[73]

In fact, in this very proceeding, the Commission has thus far declined to mandate specific protocols for the provision of VRS, precisely because it wished to "permit market forces, not the Commission, to determine the technology and equipment best suited for the provision of [VRS], and allow[] for the development of new and improved technology."[74] Snap urges the Commission to stay on this path. The VRS marketplace -- and, indeed, the entire video telephony marketplace -- is still in the early stages of its maturity, and technological change is likely to continue and, in fact, increase in the coming years. This is particularly true given that, as noted above, the rest of the communications industry has already widely adopted more advanced standards, such as SIP and H.264, which Snap believes will eventually be fully embraced by the VRS marketplace as well. In addition, recently adopted Commission rules, such as the speed-of-answer thresholds and the E-911 requirement (currently set to become effective on 7/1/07) are driving VRS providers to explore, adopt, and deploy new technologies to enhance their service offerings still further. During such a dynamic period of

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[73] *In re Amendment of the Commission's Rules to Establish New Personal Communications Services*, Second Report and Order, 8 FCC Rcd 7700, ¶ 137 (1993).

[74] *Interoperability Order* ¶ 51 (*citing Improved TRS Order* ¶ 23).

development, the above precedents and expert learning are particularly instructive -- and they all counsel against government-mandated VRS standards.

Of particular concern would be that, by mandating particular protocols for VRS, the Commission might lock in certain technology into this marketplace, thereby stifling innovation by making it more difficult and costly for VRS providers to implement newer, more functionally equivalent technologies. For example, suppose the Commission were to mandate H.323 and H.263 as VRS standards. If all VRS providers then decided that, in fact, the better standards to serve VRS users were SIP and H.264, they would not be able to simply implement these protocols; they would also have to continue to use the older H.323 and H.263 standards simply because they were mandated by the Commission's rules.

Of course, the industry could urge the Commission to change its rules to remove the reference to the outdated standards, but the process of changing a government-mandated standard is often time consuming, costly, and inefficient. For example, it took the Commission over two years to amend its ISDN rules to accommodate new technology.[75] Such time frames are inconsistent with the current rapid pace of innovation in the communications marketplace. The marketplace is a much better arbiter of such decisions, particularly given the fact that, as noted above, the Commission's existing rules already ensure that VRS interoperability will be maintained and VRS users protected.

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[75] *See* ISDN Order, 11 FCC Rcd 5091 (1996).

B. If the Commission Nonetheless Decides to Mandate Particular VRS Protocols, the Approach Must Be Forward-Looking, Narrowly Tailored, and Flexible Enough to Encourage Continued Innovation.

For the reasons discussed above, Snap believes that it is unnecessary and imprudent for the Commission to establish mandatory VRS protocols. However, if the Commission nonetheless decides to mandate such protocols, it must at the very least ensure that its decision is forward-looking, narrowly tailored, and flexible enough to encourage continued innovation in the VRS marketplace.

1. The SIP and H.264 Protocols Are Ideal Candidates if the Commission Decides to Establish Mandatory VRS Protocols.

Based on the discussion of leading signaling protocols and video codecs in Section II above, if the Commission decides to mandate specific protocols for the provision of VRS, Snap believes that SIP and H.264 would be ideal candidates. Indeed, SIP and H.264 would provide a significant stride toward truly realizing the statutory requirement that "relay services offer access to the telephone system that is 'functionally equivalent' to voice telephone services."[76]

In this regard, it is important to stress that functional equivalency is an evolving concept that must be periodically reassessed and adjusted over time.[77] Superior standards and technologies, such as SIP and H.264, are not merely "frills" or non-essential "upgrades" to today's prevalent VRS standards. Rather, they represent the best path to true functional equivalency in the current marketplace. Consider, for example, the

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[76] *Interoperability Order* ¶ 5 (*citing* 47 U.S.C. § 225(a)(3)).

[77] *See Improved TRS Order* ¶ 4 (2000) ("Functional equivalence is, by nature, a continuing goal that requires periodic assessment.").

following three ways that H.264/SIP will achieve greater functional equivalency for VRS users:

- **H.264 Will Provide Video Quality that is Functionally Equivalent to the Current High Quality of Voice Phone Calls**. The ability to communicate accurately, clearly, and without interruption is as vital for individuals with hearing and speech disabilities as it is for individuals without such disabilities. The legacy video phone technology currently used by all VRS providers -- namely, H.323- and H.263-based web cameras and/or D-Links -- often result in low-quality video phone call sessions. Among other shortcomings, these products often transmit video in a choppy manner, due to latency issues, information loss, and jitter. Such poor video quality can negatively impact communication accuracy during a VRS call and are akin to a traditional telephone conversation between hearing individuals who are unable to hear each word clearly, or at all. By contrast, H.264 offers many benefits over its predecessor H.263, including superior image quality, a simplified structure, and decreased network errors. Put in terms of functional equivalency, H.264 affords VRS users a level of video quality and communication that for the first time is truly equivalent to the clear voice quality that is available to hearing individuals making a voice telephone call over the PSTN.[78] Hearing users experience high quality voice calls that do not suffer from distortion, latency, or interference; rather, the memorable assurance in the famous Sprint TV commercials touting that voice callers can "hear a pin drop" is the high-quality norm expected by and consistently provided to hearing individuals. Fortunately, H.264 and video phones like the Ojo can now deliver the equivalent of this high-quality calling experience for VRS users. And, because H.264 includes advanced compression, transmission, and error concealment technologies, the Ojo is able to provide superior "true to life" video quality *at a lower data rate (110 Kbps)* than existing video phones, which will alleviate the need for VRS users to purchase an expensive "business class or premium" broadband service simply to make and receive VRS calls.

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[78] *See* Snap Telecommunications, Inc., *Application for Certification as a VRS Provider*, filed in CG Docket No. 03-123, at 6-8 (Jan. 25, 2006) ("*Snap VRS Application*"). Aequus (Snap's corporate parent) chose WorldGate's Ojo technology for its VRS services, believing that with the Ojo, "people who communicate with American Sign Language or through lip-reading have an exciting new way to call friends and colleagues, family members, and business and professional services. We believe Ojo is the first consumer-focused video phone capable of providing the high quality transmission required to support accurate visual communications for the community that we serve." WorldGate Communications, Inc., Press Release, *WorldGate and Aequus Technologies Bring Ojo Video Phones to Deaf and Hard of Hearing Individuals* (May 9, 2006), *available at* http://biz.yahoo.com/bw/060509/20060509006372.html?.v=1. Additionally, WorldGate's chief executive has expressed a strong interest in furthering Aequus's vision of providing high-quality video communications to millions of deaf and hard of hearing Americans. *See id.* ("We've known Aequus for some time and share their vision of helping those with disabilities to better communicate. . . . We're thrilled to finally work directly together and see Ojo playing a key role in helping the more than 8 million deaf and hard of hearing Americans communicate effectively.").

- **SIP Will Provide a Superior Platform for E-911 Services**. All VRS providers are currently exploring possible solutions to afford easy access to E-911 services for VRS users. Providing such access to VRS users is essential, and Snap is firmly committed to implementing a robust E-911 solution. One of the key advantages of SIP over H.323 is SIP's superior ability to integrate an E-911 solution that will ensure VRS users have trustworthy and immediate access to emergency services when needed. In particular, because SIP uses MIME technology for content formatting, both location information and media description can form a multipart entity in SIP message content. Consequently, using SIP, service providers will be able to know who is on their network and where they are located, allowing them to seamlessly route E-911 calls nationally to support end users.[79] Indeed, SIP is currently the focus of extensive efforts not only by Snap, but by leading industry players and standards organizations such as the IETF to develop a robust E-911 solution for IP-based services like VoIP and VRS.[80] Notably, while some E-911 providers may have support for H.323, many, if not most, do not. *See, e.g.*, TeleComSys (used by Vonage among others) at http://www1.telecomsys.com/downloads/carriers/pdf/brochure_VoIPE911.pdf. In this regard, it is worth highlighting the fact that the National Emergency Number Association ("NENA") - a 7,000-member organization whose mission is "to foster the technological advancement, availability and implementation of a universal emergency telephone number system (9-1-1)," recently published its updated E-911 specification ("i2") in December 2005 which specifies SIP for communication with E-911 location servers, *and assumes that H.323 suppliers will translate to SIP*.[81] SIP is simply the best available platform to ensure that these efforts lead to an E-911 solution for VRS that is functionally equivalent to the E-911 services that are universally available to hearing individuals.

- **SIP Will Establish an Optimal Platform for Greater Interoperability and Functional Equivalency as Technology Evolves**. As noted, the Commission has recognized that "functional equivalence" is, by nature, a continuing goal that must be periodically reassessed. As such, it is important to have VRS networks that are capable of improvement and upgrades as times and technologies change so that the functional equivalency required by the ADA can be maintained. SIP is an optimal platform to facilitate such ongoing functional equivalency. Notably, given the more highly extensible and flexible nature of SIP as compared to H.323, particularly in terms of its ability to more easily integrate new standards, codecs, and applications that may develop in the future than is possible with H.323, SIP is widely hailed as a key foundation and driver for broad interoperability and

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79 *See* Mintz-Habib, *supra* note 15, at 3.

80 *See supra* note 38 and accompanying text.

81 *See* NENA, *Interim VoIP Architecture for Enhanced 9-1-1 Services (i2)*, at 5 (Issue 1, Dec. 6, 2005), *available at* http://www.nena.org/media/files/NENA_08-001_V1_12-06-05.pdf.

innovation in IP-based services such as VoIP and VRS.[82] In short, SIP will serve as an ideal platform for ongoing compliance with the ADA's and Commission's functional equivalency and pro-innovation mandates over time.

At the same time, Snap is mindful that, notwithstanding their significant advantages and their broad support as the leading signaling and video codec open standards in the communications industry, SIP and H.264 are not currently the prevalent standards in the VRS industry, and that any effort to compel the entire industry to transition to these standards at this time would likely be costly, burdensome, and time consuming for existing VRS providers and potentially disruptive to VRS users. Again, Snap is not urging the Commission to mandate *any* standards for the reasons set out above. However, if the Commission decides to mandate SIP and H.264, it should afford all VRS providers a sufficient amount of time -- at least 18 months -- to prepare for the transition and implement the new standards into their networks and equipment.

2. If the Commission Mandates Particular VRS Protocols, It Should Also Encourage Providers to Explore and Implement Any *Other* Standards That May Better Achieve Compliance with the ADA's Functional Equivalency and Pro-Innovation Mandates.

Irrespective of which protocols the Commission mandates, if it does so at all, it is essential to allow VRS providers the flexibility to use *other* signaling and video codec standards in their networks and equipment. The benefits of this flexibility are numerous. If, for example, VRS providers can implement additional, superior signaling protocol and video codec standards in their equipment and networks that provide a higher-quality experience for VRS users, such users will no doubt increasingly use such providers and thereby drive other providers, as a competitive and business imperative, to embrace such

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[82] *See supra* notes 30-34 and accompanying text.

improved technologies as well. By contrast, if such flexibility to implement other standards is precluded, this competitive dynamic would be lost and the Commission will merely have entrenched certain standards in the VRS marketplace for an indefinite period, contrary to the functional equivalency and pro-innovation mandates of the ADA.[83]

This flexible approach is also consistent with the approach taken by the Commission in the TRS context. Initially, the Commission encouraged providers to move to ASCII (which all parties agreed was a superior technology to Baudot), but would not force it by mandating it to the exclusion of Baudot -- the legacy and prevalent TTY standard at the time.[84] The Commission noted that "[a]lthough 45.45 bps Baudot is still the dominant protocol and the one present in all TTYs, Bell 103 ASCII, V-series ASCII

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[83] *In re Telecommunications Relay Services and Speech-to-Speech Services for Individuals with Hearing and Speech Disabilities*, Notice of Proposed Rulemaking, 13 FCC Rcd 14187, ¶ 8 & nn.11-13 (1998) ("In enacting Title IV, Congress directed the Commission to ensure that persons with hearing and speech disabilities benefit from technological advances. Thus, Title IV states that 'the Commission shall ensure that regulations prescribed to implement this section encourage … the use of existing technology and do not discourage or impair the development of improved technology.' As Congress stated: [T]his legislation is not intended to discourage innovation regarding telecommunications services to individuals with hearing and speech impairments. "[T]he hearing and speech-impaired communities should be allowed to benefit from advancing technology. As such, the provisions of the Section do not seek to entrench current technology, but rather to allow for new, more efficient and more advanced technology. The Commission's NOI was released in this spirit. This Notice represents our continuation of the implementation of the statutory directive that the Commission ensure that our TRS regulations do not artificially suppress or impair the development of TRS in a changing, dynamic telecommunications landscape." (*citing* 47 U.S.C. § 225(d)(2); H.R. Rep. No. 101-485(II), 101st Cong., 2d Sess. 130 (1990)).

[84] "Despite the fact that most TTYs use Baudot, the consensus of commenters is that ASCII is a superior code because it allows use of personal computers as TT terminals, allows greater range of characters and, because it is a synchronous code, can be transmitted by standard computer modems without requiring special equipment. Although we are persuaded that a phase-out period for Baudot would be in the public interest since ASCII is, by all accounts, a superior technology, many persons who will rely on TRS have access only to Baudot terminals. ASCII devices are considerably more expensive than voice customer premises equipment, and we are reluctant to force Baudot users to purchase the more expensive equipment, especially if users have independent incentives to move to the more efficient technology voluntarily. Accordingly, while we urge both users and suppliers of TRS to facilitate the movement to ASCII, we will not deprive Baudot users of access to TRS. Therefore, we will adopt the rule as proposed." *TRS 1991 Order* ¶ 20.

protocols, and proprietary protocols are also used in TTY products. Many TRS centers support all of the open protocols, and some support TurboCode by Ultratec, which is a proprietary protocol."[85] Furthermore, even after the Commission mandated ASCII and Baudot as required TRS standards, the Commission "left decisions about technology for relay platforms to the discretion of the relay provider, as long as both Baudot and ASCII are supported 'at any speed generally in use.'"[86] Indeed, as noted, the Commission's general policy in regulating TRS services has been to take a market-based approach by allowing carriers the "time to evaluate which approach is best" and the discretion to determine which technologies to employ next.[87]

In short, if the Commission mandates *any* VRS protocols, it should at the very least follow the same approach used in the TRS context and allow all VRS providers to utilize *other* protocols as well, such as SIP and H.264, as long as interoperability with the mandated baseline protocols is achieved. Finally, as discussed in the next section, in order to further promote these important innovation-enhancing objectives, the Commission must also make absolutely clear that any costs incurred by VRS providers either to implement mandated VRS protocols or to otherwise comply with the Commission's interoperability requirements are compensable from the Interstate TRS Fund.

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85 *Improved TRS Order* ¶ 139.

86 *Id.* ¶ 143 (*citing* 47 C.F.R. § 64.604(b)(1)).

87 *In re Telecommunications Services for Hearing-Impaired and Speech-Impaired Individuals, and the Americans with Disabilities Act*, Notice of Proposed Rulemaking, 5 FCC Rcd 7187, ¶ 10 (1990), *subsequent history omitted*.

IV. THE COMMISSION SHOULD CONFIRM THAT VRS COSTS INCURRED TO COMPLY WITH THE COMMISSION'S INTEROPERABILITY REQUIREMENTS (*REGARDLESS* OF WHETHER VRS PROTOCOLS ARE MANDATED) ARE REIMBURSABLE FROM THE INTERSTATE TRS FUND.

A. Interoperability Costs Qualify Under the Commission's Legal Standard for Reimbursement.

The FNPRM also seeks comment on "what costs may be involved if we require all providers to be able to receive and make calls through specific multiple protocols, and whether such costs should be compensable by the Fund."[88] Generally, the Commission's rules and precedent provide that VRS costs will be reimbursed to the extent they: (1) are directed at compliance with a non-waived mandatory minimum VRS standard; and (2) are reasonable.[89] Applying this two-part test, were the Commission to mandate one or more specific protocols through which all VRS providers must receive and make calls, the costs to comply with such a new mandatory minimum standard would be

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[88] *Interoperability Order* ¶ 56.

[89] *See* 47 C.F.R. § 64.604 (c)(5)(iii)(E) (specifying that TRS Fund distributions are "designed to compensate TRS providers for reasonable costs of providing interstate TRS" and that the administrator "shall make payments only to eligible TRS providers operating pursuant to mandatory minimum standards…"); *In re Telecommunications Relay Services and Speech-to-Speech Services for Individuals with Hearing and Speech Disabilities*, Report and Order, Order on Reconsideration, and Further Notice of Proposed Rulemaking, 19 FCC Rcd 12475, ¶ 179 (2004) (noting that the cost recovery framework -- and the annual determination of the TRS compensation rates -- "is not akin to a ratemaking process that determines the charges a regulated entity may charge its customers," but rather is intended to "cover the reasonable costs incurred in providing the TRS services mandated by Congress and our regulations."); *id*. ¶ 181 (construing "reasonable costs" as "those direct and indirect costs necessary to provide the service consistent with all applicable regulations governing the provision of the service, i.e., the TRS mandatory minimum standards.") (footnote omitted). *In re Telecommunications Relay Services and Speech-to-Speech Services for Individuals with Hearing and Speech Disabilities*, Memorandum Opinion and Order, FCC 06-88, ¶ 16 (rel. July 12, 2006) ("*2006 TRS Rate Order*") ("compensable [TRS] costs must be directed to providing the service in compliance with applicable non-waived mandatory minimum standards.") (footnotes omitted).

compensable by the Fund, subject to the ability of NECA and/or the Commission to limit certain costs that are found not to be reasonable under the circumstances.[90]

Moreover, even if the Commission decides not to mandate *any* specific VRS protocols in this proceeding, the costs incurred by VRS providers to comply with the Commission's existing interoperability requirements would still be compensable from the Fund. As noted above, in the Interoperability Order, the Commission made clear that "all VRS consumers must be able to place a VRS call through any of the VRS providers' service, and all VRS providers must be able to receive calls from, and make calls to, any VRS consumer."[91] The Commission also required that "new providers seeking to offer [the VRS] service have the burden of ensuring that their service is interoperable with existing providers' service,"[92] and prohibited the "practice of providing degraded service quality to consumers using VRS equipment or service with another provider's service."[93]

These requirements clearly constitute new mandatory minimum standards of the VRS rules since non-compliance renders a VRS provider "ineligible for compensation from the Interstate TRS Fund."[94] In fact, the Commission was unequivocal in its Declaratory Ruling that the

> [r]easonable costs of compliance with this *Declaratory Ruling* are compensable from the Fund. Because the providers will be recouped for the costs of compliance within a reasonable period, we assert that the providers will not be detrimentally burdened. Therefore, we certify that

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90 *See 2006 TRS Rate Order* ¶¶ 6-8.

91 *Interoperability Order* ¶ 29.

92 *Id*. ¶ 34.

93 *Id*.

94 *Id*. ¶ 29 (citations omitted).

> the requirements of the *Declaratory Ruling* will not have a significant economic impact on a substantial number of small entities.[95]

This demonstrates that the Commission considers compliance with its interoperability requirements to be part of the mandatory minimum standards for VRS and therefore the reasonable costs to comply with these requirements are reimbursable by the Fund, *regardless* of whether the Commission also mandates particular VRS protocols in this proceeding. Indeed, this is the very same approach the Commission has taken in the past with new VRS requirements such as speed-of-answer and 24/7 operation, in which it has expressly noted that costs to comply with such requirements are reimbursable.[96]

Accordingly, any costs that new entrants -- or even incumbent providers -- incur when seeking to make new technology backwardly compatible with existing standards pursuant to the Commission's interoperability requirements should be compensable under the Commission precedent cited above, subject, of course, to the ability of NECA and the Commission to review such costs for reasonableness.

For example, Snap notes that it will incur costs of between $350,000-$450,000 for the design, software programming, implementation, and testing of an interoperability solution in its network that will ensure interoperability with existing providers using H.323 and H.263, which is a reasonable cost for the innovative, efficient, and comprehensive solution Snap will employ.[97] These costs will cover two primary

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[95] *Id*. ¶ 76.

[96] *2006 TRS Rate Order* ¶ 15 ("costs [for the speed-of-answer and 24/7 service requirements] may be included in subsequent cost submissions, and the resulting rate will reflect reasonable costs incurred to comply with these new requirements.") (citations omitted).

[97] Snap notes that the interoperability solution described in this Section is a slightly different, but also more elegant, solution than the one described in Snap's March 31, 2006 *ex parte* letter to the Commission. *See Ex Parte* Letter of Snap Telecommunications, Inc., CG Docket No. 03-123 (filed Mar.

modifications to Snap's business plan and its VRS network. First, Snap will add a media gateway server to its call center ("Media Gateway") to provide translation of incoming VRS calls from the SIP to the H.323 protocol and vice versa. Second, Snap has commissioned its video phone supplier and systems integrator, WorldGate Communications Inc., to redesign the Ojo and implement support for the H.263 video codec into this video phone and the Snap network in addition to the newer and more advanced H.264 video codec. The Media Gateway in the Snap call center will automatically handle the SIP-H.323 interoperability, while the integration of H.263 will ensure backward compatibility with existing video phones that use the older H.263 video compression standard.

Thus, Snap's interoperability solution will allow a Snap!VRS user to use his or her Ojo to place a VRS call to any of the other VRS providers, all of which use H.323/H.263-based phones, and will also allow a VRS user with an H.323/H.263-based phone to call the Snap!VRS call center and engage in a VRS call through a Snap communications assistant who is using an Ojo. Snap's interoperability solution will be transparent to the end user, and, consistent with the Commission's interoperability order,

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31, 2006) (noting that it would take Snap 9-12 months to design, deploy, and test its interoperability solution). The 3/31/06 *ex parte* letter included a description of a real-time conversion process that would convert H.264 to H.263 and vice versa using new equipment and software to be installed in the Snap call center. After further research and discussions between WorldGate and Snap, it was decided to further streamline this process by installing the H.263 protocol directly in the Ojos themselves so that no such real-time conversion between H.264 and H.263 would be needed, but rather that the Ojo could "talk" directly to an H.263-based phone. The interoperability solution described herein is superior because (1) it eliminates the slight delay and signal degradation that would have resulted from the H.264-H.263 conversion, (2) it dramatically reduces the recurring costs of the initial proposal since new T1 lines need not be ordered for the call center to handle such real-time video codec conversions (although the one-time design, implementation, and testing costs increase under this more elegant solution to between $350,000 and $450,000), and (3) it distributes the intelligence and processing of the interoperability solution more broadly across various network components, thereby enhancing the reliability of the solution since the call center is no longer the potential bottleneck and single point of failure.

Snap as the new entrant will bear all the burden and costs to implement this solution for both outgoing and incoming VRS calls.

Because Snap is expending these costs specifically to achieve compliance with the Commission's mandatory interoperability requirements set forth above, Snap's costs should be compensable from the Interstate TRS Fund, as should the costs incurred by any of the incumbent VRS providers that decide to implement new standards/technologies (*e.g.*, SIP/H.264) into their networks and, thus, must also implement a mechanism to ensure backward compatibility with H.323/H.263-based VRS providers and users.

B. Reimbursement for Interoperability Costs is Necessary to Encourage Providers to Invest in, and Deploy, Technologies that Continue to Achieve Functional Equivalency.

Not only is such cost reimbursability required by the Commission's rules and precedent, it is also the correct public policy choice. Most importantly, reimbursement for interoperability costs encourages providers -- both existing providers that are currently using H.323 and H.263, and future market participants alike -- to invest in and implement technologies that continue to achieve functional equivalency and better serve VRS users.

By contrast, if the Commission were to deny cost reimbursement for efforts to comply with such interoperability requirements, not only would this decision be squarely at odds with its VRS rules and precedent, but equally important, the above incentives and competitive dynamics would be significantly dampened and the Commission will merely have entrenched certain technologies in the VRS marketplace for an indefinite period, contrary to the functional equivalency and pro-innovation mandates of the ADA.

V. CONCLUSION

Based on the foregoing, Snap respectfully urges the Commission to adopt rules in this proceeding consistent with the comments herein.

Respectfully submitted,

/s/ Francis M. Buono

Daryl Crouse
SNAP TELECOMMUNICATIONS, INC.
925 Wappoo Road
Suite C
Charleston, SC 29407
(843) 763-3890 (Voice)
(843) 763-3944 (TTY)

Richard L. Schatzberg
AEQUUS TECHNOLOGIES CORP.
107 Windsor Drive
Pine Brook, NJ 07058
(973) 713-4124 (Voice)

Francis M. Buono
McLean Sieverding
WILLKIE FARR & GALLAGHER LLP
1875 K Street, N.W.
Washington, DC 20006-1238
(202) 303-1000
Counsel for Snap Telecommunications, Inc.

EXHIBIT

Chart of Video Phones

Video Phones and Standards Used By Existing VRS Providers

Provider	Manufacturer/ Model	Type	Transmission Standard(s)	Video Codec(s)	Audio Codec(s)	Broadband Minimum Speed
CAC	Dlink i2eye (DVC-1000)	Video phone (TV-based)	H.323	H.263	G.711 G.723	128 kbps upload and download
CSD	Dlink i2eye (DVC-1000) and any H.323- compatible Video phone.	Video phone (TV-based)	H.323	H.263	G.711 G.723	128 kbps upload and download
	Polycom ViaVideo II (or H.323 compatible devices)	Video phone (stand-alone)	H.323	H.261 H.263 H.263+	G.711 G.723.1 G.728	128 kbps upload and download
	Microsoft NetMeeting and camera CCD sensor web cameras are recommended. CMOS sensor web cameras are actively discouraged.	PC and web camera	H.323	H.261 H.263	G.711 G.723	Minimum: 128 kbps upload and download
GoAmerica Communications Corp.	Currently only providing wireless IP Relay					
Hamilton Relay	Dlink i2eye (DVC-1000) and any H.323- compatible Video phone.	Video phone (TV-based)	H.323	H.263	G.711 G.723	128 kbps upload and download
	Polycom ViaVideo II (or H.323 compatible devices)	Video phone (stand-alone)	H.323	H.261 H.263 H.263+	G.711 G.723.1 G.728	128 kbps upload and download
	Microsoft NetMeeting and camera CCD sensor web cameras are recommended. CMOS sensor web cameras are actively discouraged.	PC and web camera	H.323	H.261 H.263	G.711 G.723	Minimum: 128 kbps upload and download
Hands On VRS (“HOVRS)	Dlink i2eye (DVC-1000) and any H.323- compatible Video phone.	Video phone (TV-based)	H.323	H.263	G.711 G.723	128 kbps upload and download
	Polycom ViaVideo II (or H.323	Video phone	H.323	H.261	G.711	128 kbps upload and download

Provider	Manufacturer/ Model	Type	Transmission Standard(s)	Video Codec(s)	Audio Codec(s)	Broadband Minimum Speed
	compatible devices)	(stand-alone)		H.263 H.263+	G.723.1 G.728	
	HOVRS VideoSign 2.5 software CCD sensor web cameras are recommended. CMOS sensor web cameras are actively discouraged.	PC and web camera	Unknown (Likely the same as Net Meeting)	Unknown (Likely the same as Net Meeting)	Unknown (Likely the same as Net Meeting)	
	Microsoft NetMeeting and camera CCD sensor web cameras are recommended. CMOS sensor web cameras are actively discouraged.	PC and web camera	H.323	H.261 H.263	G.711 G.723	Minimum: 128 kbps upload and download
Healinc Telecom, LLC ("Lifelinks VRS")	Dlink i2eye (DVC-1000) and any H.323- compatible Video phone.	Video phone (TV-based)	H.323	H.263	G.711 G.723	128 kbps upload and download
Nordia	Dlink i2eye (DVC-1000) and any H.323- compatible Video phone.	Video phone (TV-based)	H.323	H.263	G.711 G.723	128 kbps upload and download
	Polycom ViaVideo II (or H.323 compatible devices)	Video phone (stand-alone)	H.323	H.261 H.263 H.263+	G.711 G.723.1 G.728	128 kbps upload and download
	Microsoft NetMeeting and camera CCD sensor web cameras are recommended. CMOS sensor web cameras are actively discouraged.	PC and web camera	H.323	H.261 H.263	G.711 G.723	Minimum: 128 kbps upload and download
Sorenson	Sorenson VP-100		H.323	H.263	G.711 G.723	Minimum: 256 kbps upload and download
	Sorenson Envision SL CCD sensor web cameras are recommended. CMOS sensor web cameras are actively discouraged.		Unknown (likely the same as NetMeeting)	Unknown	Unknown	Minimum: 128 kbps upload and download
	Microsoft NetMeeting and camera	PC and web camera	H.323	H.261 H.263	G.711 G.723	Minimum: 128 kbps upload and download

Provider	Manufacturer/ Model	Type	Transmission Standard(s)	Video Codec(s)	Audio Codec(s)	Broadband Minimum Speed
	CCD sensor web cameras are recommended. CMOS sensor web cameras are actively discouraged.					
	SightSpeed Software	PC and web camera	Unknown	Unknown	Unknown	"Cable modem or DSL high-speed internet connection"

SIP-based Video Phones Currently Available in the Marketplace

Manufacturer/ Model	Type	Transmission Standard(s)	Video Codec(s)	Audio Codec(s)	Broadband Minimum Speed
1. Corinex Internet Video phone	PC and web camera	SIP 2.0	H.264 (mpeg-4)	G.711 G.721 GSM	128 kbps
2. Counterpath eyebeam	PC and web camera	SIP	H.263	G.711, iLBC, Speex, GSM, G.723.1, G.726, G.729a & EVRC	64 kbps
3. Grandstream GXV-3000 SIP Video phone #16294	Video phone (stand-alone)	SIP 2.0	H.264	G.711-A/u, G.723.1 G.729 (a/b) G.726 (pending) GSM G.722 (pending)	32 kbps
4. Innomedia MTA 5531 5. Innomedia MTA 5410	Video phone (stand-alone)	SIP 2.0 (H.323 compatibility may be available)	H.261 H.263 H.263+	G.711 (A/U) G.723.1 G.729 (G.728 may be available)	64 kbps to 768 kbps
6. Innomedia MTA 5410S	Video phone (stand-alone)	SIP 2.0	H.264	G.711 (A/U) G.723.1 G.729	64 kbps to 256 kbps
7. Innomedia MTA 5500	Video phone (stand-alone)	SIP 2.0	H.264	Unknown. Specification not available yet.	Unknown
8. Leadtek BVP8762	Video phone (stand-alone)	SIP	H.261 H.263	G.711 G.723.1 G.729	Unknown
9. Leadtek XTP 8830	Video phone (stand-alone)	SIP and H.323	H.264	Unknown (Specification not yet available)	Unknown
10. Packet8 DV326 Video phone	Video phone (stand-alone)	SIP	H.261, H.263	G.711, G.723.1	84Kbps to 684Kbps
11. ProVu WVP-2100	Video phone (stand-alone)	SIP and H.323	H.261 H.263. H.264 in development	G.711-A/u, G.723.1	Unknown
12. PureData VP-30H	Video phone (stand-alone)	SIP and H.323	H.263 H.263+	G.711, G.723.1, G.729A/B	Unknown
13. Sightspeed	PC and web camera	SIP	Codec created by Cornell University's Laboratory for	Unknown	Unknown

Manufacturer/ Model	Type	Transmission Standard(s)	Video Codec(s)	Audio Codec(s)	Broadband Minimum Speed
			Digital Image and Signal Coding Research. SightSpeed has an exclusive license for this technology.		
14. Sony / Glowpoint IVE	PC and web camera	SIP client and H.323 gateway	H.263 H.264	Unknown	Unknown
15. TABLETmedia iFon	Video phone (stand-alone)	SIP and H.323 rev.4	User-selectable rate control: H.261. Optional: H.263 MPEG-4. H.264 in Q2 06.	G.711 (A/u) G.722 (optional) G.723.1 (optional) G.729A (optional)	Unknown
16. Viseon Visifone	Video phone (stand-alone)	SIP	H.263 H.264	G.711 G.722 G.723.1A G.726 G.728 G.729.A/B	64 to 384 kbps
17. Vizufon CIP-4500	Video phone (stand-alone)	SIP and H.323v2	H.263 H.264	G.723.1, G.711	64 kbps
18. WorldGate Ojo	Video phone (stand-alone)	SIP	H.264	G.711	110-150 kbps